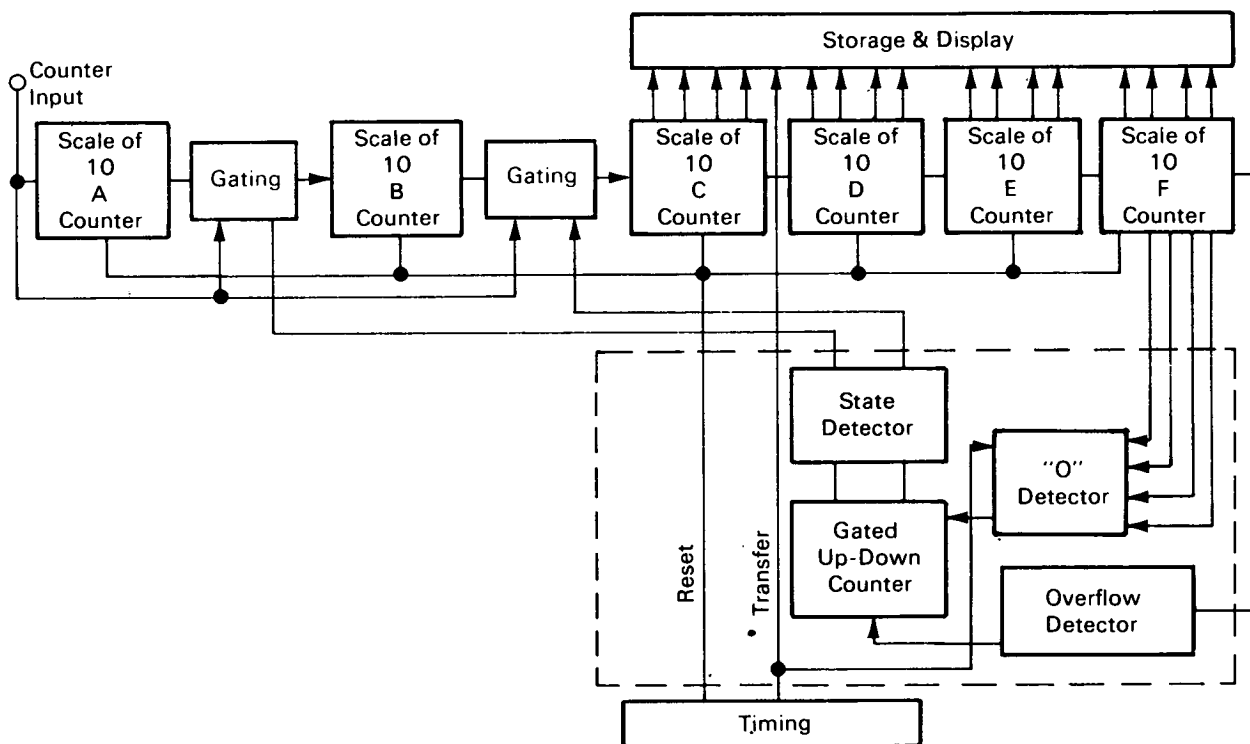


# AEC-NASA TECH BRIEF



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## Inexpensive Automatic Ranging for Digital Voltmeters and Frequency Counters



Automatic Ranging Added to Electronic Counter or Counting Digital Voltmeter

### The problem:

In a digital voltmeter or an electronic counter, a counting technique is utilized to provide accumulation of signals for display purposes. Certain types of digital voltmeters perform a voltage-to-frequency (V-F) conversion and the frequency is then counted for a precise time interval; the count accumulated is proportional to the input voltage. In the more economical digital voltmeters and frequency counters, manual range changing is accomplished by means of a switch;

automatic range changing is not provided because the circuits are complicated and increase the cost of the instrument greatly. Thus, the user is forced to accept a lesser number of significant digits of display or to change the scale of the display manually when the input variable is not of a level sufficient to activate the most significant digit of the display.

### The solution:

A simple automatic ranging circuit which can be incorporated at very low cost into V-F digital volt-

(continued overleaf)

meters and frequency counters. Extra decades are switched into and out of the counting chain as a function of the contents of the counter during the previous counting period.

**How it's done:**

The counting path and display section in a counter of a digital voltmeter are illustrated in the figure. The counter is capable of a maximum of 6 decades of counting, 4 of which are displayed. The remaining 2 decades of binary-coded decimal counting may be switched in and out by the blocks marked "gating" in the "manual" meters; the gating blocks are switches manually set to the desired position. In the "automatic" version these blocks are transistor gates, controlled by the circuit elements shown within the dotted box. These elements sense the contents of the counter (overflow, or most significant digit equals zero, or neither) during a counting period, and switch the gating blocks appropriately for the next period. This automatic ranging circuit requires about seven low-

cost integrated circuits in the counter and would increase the voltmeter cost by about \$30 to \$50.

**Notes:**

1. Typically, this improvement should be of value in production lines and industrial quality control acceptance stations.
2. Requests for further information may be directed to:

Technology Utilization Officer  
AEC-NASA Space Nuclear Propulsion Office  
U.S. Atomic Energy Commission  
Washington, D.C. 20545  
Reference: B70-10530

**Patent status:**

No patent action is contemplated by AEC or NASA.

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